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ABSTRACT

This study investigated the attitudes and opinions of three students with and three students without learning disabilities regarding the use of computers for school-related work. The students (in grades 5 through 12) were selected from three school sites and interviewed in-depth. Analysis of interviews with open-coding procedures identified five general themes: applications of computers, instructional uses of computers, attitudes about computers, personal experience with computers, and resource needs. Comparison of students with and without learning disabilities showed that although most students were generally positive about computers, students with learning disabilities had qualitatively different experiences with computers and less positive attitudes about computers than those without learning disabilities. These students also expressed greater frustration about learning to use a computer and were more equivocal about the role of computers in educational programs. The most salient finding was the connection between participant attitudes and prior computer-related experiences. Results suggest the need to integrate instruction about technology into early intervention programs for students with learning disabilities. (Contains 35 references.) (DB)

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Computers as Accessibility Tools for Students With and Without Learning Disabilities

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Abstract

This study investigated the attitudes and opinions of students with and without learning disabilities regarding the use of computers for school-related work. Using in-depth interviews, three students with learning disabilities and three students without learning disabilities were interviewed. The students were selected from three school sites, consisting of students in grades 5 through 12. The interviews were coded using Glaser and Strauss' open-coding procedures. This process yielded nine main codes with corresponding sub-codes. The codes were refined into five general themes: applications of computers, instructional uses of computers, attitudes about computers, personal experience with computers, and resource needs. Comparison of the interviews of students with and without learning disabilities showed that students with learning disabilities had qualitatively different experiences with computers than those without learning disabilities. Implications are that when planning for computer use within the general education curriculum, taking individual needs into consideration around technology is as critical as considering individual needs around instruction.

Computers as Accessibility Tools for Students With and Without Learning Disabilities

Computers and Students with Special Needs

How do students view the use of computers for school work? Many educators assume that students see them as tools that make school more fun and learning more interesting. Very little research has investigated students' attitudes toward computers even though more computers are being placed in cl.ssrooms every year. There has been even less research into whether students with learning disabilities hold different views about computers than their non-disabled peers. This study investigated the attitudes that students with and without learning disabilities held about computers and their use in schools. The goal of the research is to facilitate better the interface of technology with instruction.

An increasing body of research indicates that computers and other forms of instructional technology (IT) are positively related to student achievement, as measured by both curriculum-based and standardized outcome variables (Fletcher-Flinn & Gravatt, 1995; Khalili & Shashaani, 1994; Kulik, 1994). Other studies have shown that computer-based instruction (CBI) can be especially effective for students with special needs (Church & Bender, 1989; Fitzgerald & Koury, 1996; Goldenberg, 1989; Goldenberg & Russell, 1984; Kearsley, Hunter, & Furlong, 1992; Male, 1993, 1994) While the prior research has shown that computers are related to positive outcomes in student achievement, little research has been done to learn about the relationships between computer use and students' attitudes and opinions about their use. Given that computers are likely to remain a part of the school environment, it makes pedagogical and economic sense to learn how their use can best enable students. This study used the knowledge base and experiences of students with and without learning disabilities to learn their perceptions of the usefulness of computers in schools.

It seems likely that students' beliefs about computers are likely to shape the extent to which computers enhance their achievement, academically, socially, or personally. Since little research has been completed in this area to date, students' attitudes and opinions concerning the use of computers in schools were investigated, with a special focus on the use of computers by students who perhaps stand to benefit the most from them: students with learning disabilities. The purpose of this research was to learn: a) whether students with and without learning disabilities believe that computer applications make a difference in students' learning, b) whether these students believe that computers can benefit students with special needs

more than others, c) whether their own computer skills are related to these beliefs, and d) whether there are differences in the computer attitudes and beliefs of students with and without learning disabilities. These data provided indicators of the relationships between students' computer skills and experiences and their attitudes about the role of computers in school-based instruction. Given that the research literature shows that computers are related to positive outcomes for all students, the ultimate goal is to determine, based on the collected data, what policy decisions, training models, and protocols might facilitate the most effective use of computers by and for all students, especially those with special needs.

A few earlier studies have looked at students' beliefs about computer use in schools and offered preliminary findings about attitudes, opinions, and overall use (King, 1995; Kinnear, 1995; Murphy, Coover and Owen, 1989; Proctor & Burnett, 1996; Riggs & Enochs, 1993). The Riggs and Enochs (1993) as well as the Murphy, et al. (1989) studies focused on validating computer beliefs instruments and offered insights into how such research might be conducted. King's (1995) work showed that students do not always perceive computers as generally helpful, and that other variables influence their usefulness. Proctor and Burnett (1996) indicated that greater frequency of access and use of computers is related to more positive student attitudes about them. Kinnear's (1995) work suggested that more study of how students perceive computer use is needed. Of note, Kinnear's was the only study which used interviews of students as a means of learning about students' experiences using computers; her findings suggested that this method could yield important data. Olivier and Shapiro (1993) showed that there is a very high correlation between actual use and computer efficacy among students. This finding, more than the others, points to the importance of understanding more about students' computer skills, beliefs and attitudes.

Method

Following Pajares' (1992) recommendations for beliefs-oriented research, this study used qualitative data collection and analysis methods to learn more about students' attitudes about the role of computers in education. The data were collected using in-depth interviews with selected students from three different schools. The data reported here were part of a larger study of how students' and teachers' attitudes about computers changed after the implementation of a school-wide computer network.

Research Questions

The specific research questions addressed in this study are

1. How do students with and without learning disabilities view computer use in schools?
2. Are the computer attitudes of students with learning disabilities different from those of students without learning disabilities and how does that influence their interaction with technology?

Sites

The interviews were conducted with students from Riverview, a public elementary school for grades Pre-K through 6, Fairmont, a private boys' boarding school for grades 6 through 9, and Wesley Academy, a private co-educational boarding school for grades 7 through 12. The schools participating in this study were given pseudonyms to provide anonymity. All three schools are located in non-urban communities in the Northeast United States near the university, but not in the same town, where the researchers are affiliated. The schools were chosen because they had students representing a variety of grades and had varying levels of computer technology. Together, these factors allowed for an exploration of how students' grade, computer experience, and level of computer technology available interact to influence their beliefs and attitudes about computers.

Fairmont. Fairmont is a middle grades boarding school. It was founded after World War I as a pre-prep school for boys going on to pre-college preparatory academies. The school admits boys, and the daughters of faculty and staff who work at the school, in grades 6 through 9. Approximately 25 percent of the students are day students from surrounding towns and the rest are boarding students. On average, the school has a very diverse population with students from up to 30 states and 11 foreign countries. At the time this study was conducted, approximately 21 percent were international and not native English speakers (n = 52). The school's students represent a very diverse range of academic skill levels. Ten percent (n = 26) of students during the year this research was conducted had diagnosed learning disabilities (LD), 8% had Attention Deficit Hyperactivity Disorder (ADHD; n = 19); four students had both a learning disability and ADHD. In addition, one student with a hearing impairment and one student with physical disabilities attended the school. Overall the school's population of students with special learning needs was 16 percent, slightly above the national average of about 12%. Students with special learning needs are fully included in all classes, with the occasional exception of a foreign language waiver being granted to students with language learning disabilities. Most of the students with learning disabilities or ADHD attend the school's resource room program one period a day. Additional academic support is provided when needed by

privately hired tutors. The school also has a number of students with very strong academic skills, including students who have participated in nationally screened programs for students identified as talented and gifted.

At the time this study was conducted, Fairmont had recently undergone the implementation of a campus wide technology plan (Solberg, 1996). At the center of this plan was the installation of a campus-wide wide area network (WAN). This WAN connected the classrooms, library, faculty work areas, administrative offices, and dormitories on one network. The backbone of the WAN is fiber optic cable that connects each building to the main servers. Category five (UTP: 100mg/sec) data cabling was used within buildings for individual workstation connections to support fast ethernet connections. In addition, the existing computer lab was completely re-done and 14 new, network capable, Power Macintosh computers for student and faculty use were installed. During the study year the computer room was available for individual and class use throughout the class day and for individual student and faculty use during the afternoon study hall hour. It was also made available to boarding students during free times on weekends for academic projects. These computers provided a range of software, including Microsoft Word, Claris Works, Hyper Studio, and several typing tutorials. Seven of the computer room computers were linked to the network, allowing Internet access for supervised use exclusively during elective periods. The existing search station computers in the library, five Hewlett-Packard Vectra 4/66 series, were updated with new software for electronic database searches. An additional IBM Pentium series Internet station was added for student and faculty use. Four of the old computer room Macintosh LC II computers were placed in the library equipped with Microsoft Word and Internet software for student use.

No school-wide training for students was provided, although, many individual faculty incorporated computer use and instruction in their classes. Student training in computer use was not provided because it was felt that the students would be able to learn how to use the new equipment from incidental learning and peer interactions. The English Department established a computer literacy program for all students in the ninth grade. This program consisted of direct instruction in basic word processing skills by the computer teacher and the requirement that certain English assignments be completed using a word processor. In addition, computer related elective courses, ranging from typing, Hyper Studio, Internet use and computer rendering (graphic arts program) were offered throughout the school year. These programs were supported by one full time computer teacher and a full time computer coordinator. In addition, several students organized and taught two computer related classes with the support and supervision of faculty members.

Riverview. A newly constructed public elementary school serving students in grades Pre-Kindergarten through 6 served as one of the control sites. This school was to have served as a second experimental site, but, the planned computer network was delayed by one year. At the time of the study, Riverview had an enrollment of 393 students. Prior to this new construction, the town's elementary age students were served by two separate elementary schools. Given the rising elementary age school population in the town, it was decided to build a single site for these students. The school was designed with the use of technology in mind. The necessary wiring to support academic and administrative computing was installed at the time of construction. The funding to purchase the necessary computer hardware and software was provided by a supplementary budget. As a result, these items were not in place when the school opened. Of the total population of students in grades Preschool through 6, 55 (14%) received special education services, 39 (10%) were eligible for free or reduced cost lunches, and 24 (6%) were non-native English speakers. The school provides a range of special education services on site, ranging from mild to severe special needs. Where possible, inclusive educational practices are used to provide students with special needs an education in the least restrictive environment (LRE).

Existing computer resources from the two former elementary schools were brought over to the new school when it opened. These resources included several administrative computers and 14 stand-alone Commodore 64 computers which were located in the fifth grade math teacher's classroom. In addition, all the other fifth and sixth grade teachers had one Apple IIe computer in their classrooms for student and teacher use. There was no appointed technology teacher, but one of the fifth grade teachers served as the unofficial coordinator for the building during the school year when the study was conducted.

Wesley Academy. The secondary school site was chosen for two reasons. First, this school has a well-established program for students with special needs and such students represent about 15% of the student body (n = 49 students). Second, no additional computer resources were planned for the study year. Wesley Academy is a co-educational private boarding school with traditions dating from before the U.S. Civil War. The school enrolls students in grades 7 through post-graduate year. Students in the middle school, grades 7 and 8, have their own program and separate classes and most middle school students are day students. The school attracts a diverse student body with an international student population of approximately 18 % (n = approximately 60). Specific information about subtypes of learning disabilities was unavailable. Students with disabilities are fully included in all regular classes, with the exception of some language waivers. Specific learning needs are addressed during daily one-on-one sessions with the special education faculty members.

Existing technology resources at Wesley included a computer lab with 12 Macintosh and 4 Power Macintosh computers. This lab was available for individual and class use throughout the class day and during study hall times during the study year. In addition, each department chair had a Power Macintosh or Macintosh computer in the departmental office. All the middle school classrooms had one Macintosh Classic or SE computer for student use. Most administrative offices had stand-alone computers. The library had two single-user CD-ROM search stations and software for student and faculty use. The card catalog was not computerized. There was no central computer network or server. Modems were available for use by students with their own computers in the dorm and for department chairs to use for Internet connections. There was one part- time computer and technology coordinator.

Participants

Participants were selected from among all the students at the three sites who were willing to participate, with the exception of an age-selected group at the elementary school. While enrollment at the two private schools is by admission only, these schools have traditionally admitted students with varying ranges of ability, including students with special needs. Thus, the population of students with special needs at these schools (15-16%) is near enough to the national average of 12% to make the results potentially generalizable to the overall population of students with special needs.

Prior to selecting the participants for this study, the researchers discussed the selection of interview subjects with administrative personnel at each school. Candidates were nominated by school personnel based on the research objectives. School personnel were asked to nominate students who were considered representative of their peers, but also possessing sufficient verbal skills to engage in an in-depth interview process. Once a pool of interview candidates was made, the students were asked in person by the researchers if they were willing to participate in an interview. Two students from each school ($n = 6$) were selected to be interviewed using structured interviewing techniques (Marshall & Rossman, 1995; Seidman, 1991). All six interview nominees agreed to participate. All interviewed students and their parents provided their written consent to participate in the interviews. The potential interview participants' parents were contacted first in writing by the researchers to request permission for their child to be interviewed. A follow-up phone call was made to clarify the interview purposes and procedures and to answer any further questions. Each interview subject met personally with the interviewer to go over the written consent form and to discuss the interview process in a session prior to the actual interview.

General information about the interview subjects is found in Table 1. Half (3) of the students were identified as having a learning disability. Among the students, years of experience using computers varied with age, however, all reported that they began using computers between ages five and eight. Information concerning the interview participants' sense of their computer skills was also collected. None of the subjects reported not having computer skills, but they did indicate a wide range of skill level, from poor to excellent.

<Insert Table 1 about here>

Student Profiles

The above data provided very general information about the interview participants. The following interview profiles give more background information about each participant and provide a context for each participant's computer-related experiences.

Darren: "So many possibilities." Darren, a 14 year old ninth grader, in his second year attending Fairmont when the interview was conducted, saw computers as offering students more options. He had chosen to attend a boarding school because his father's work with an international corporation involved overseas postings. Darren and his family have lived in Southeast Asia, Africa, and Europe as a result of his father's work. With the exception of the second and third grades in the United States, Darren attended English language international schools through the sixth grade and then came to the United States as a boarding student starting in the seventh grade.

Darren described his school experiences as generally positive, reporting that he has always enjoyed school. Darren had no history of a learning disability or school problems. He enjoyed his time at the international schools but described them as being small. He appreciated the chance to attend boarding schools which have larger student populations. Darren reported that he has always been a fairly successful student, reporting that "I like to learn".

Nathan: "It's harsh!" In contrast to Darren, Nathan offered a very different view of the role of computers for helping students with different learning needs. Nathan was fifteen at the time of the interview and was completing his ninth grade year at Fairmont. Nathan had attended Fairmont for four years, starting in the sixth grade, taking advantage of the school's academic support services to deal with his dyslexia. Both of Nathan's parents are teachers and he was a day student at Fairmont. Nathan's parents were teaching at a boarding school on the West coast when he was born. When Nathan was two, the family moved to the Northeast to another boarding school, leaving there when Nathan was in the first grade to work at their current boarding school not far from Fairmont.

Frances: "I can see kids working all together." Frances, a 12 year old sixth grade girl at Riverview with no history of learning problems, focused on the social potential of computers. She was a very busy student who participated in a number of activities in and out of school. Frances had attended the public schools in her town since Kindergarten. She was a member of the school band and chorus, served on the student council, and participated regularly in ballet, figure skating, and soccer programs in the local community. Frances reflected a very positive and upbeat attitude about school, reporting that she likes her classes, especially math.

Stewart: "unmeasureable things." Stewart, a twelve year old boy in the sixth grade at Riverview when the interview was conducted, offered a hopeful vision of the future of computers. A student with no history of learning difficulties, he had attended the public schools in this town since first grade. A good student, Stewart was also very involved in a gymnastics program in the local community which involved training three hours daily, five days a week. Stewart immediately showed his strong interest in computers, revealing a high level of expertise. He spoke primarily of the uses of computers for school and home tasks but also made mention of specific needs for computers at his school.

Michelle: "It was really frustrating." Michelle, a 14 old girl in eighth grade at Wesley Academy, expressed ongoing frustration about computers. In her first year at Wesley Academy at the time of the interview, Michelle had attended public schools in two Northeast communities prior to choosing Wesley Academy for the eighth grade. This choice was made as a result of her mother's frustration with Michelle's lack of progress at the local middle school.

Michelle was identified as having Attention Deficit Hyperactivity Disorder (ADHD) in fourth grade. She was first treated with stimulant medication, which, she reported, helped her concentrate better but also depressed her. Her mother, a physician, discovered that Michelle was not taking her medication and an alternative medication was found which did not create the depressive side effects. Michelle reported that she likes her new school very much. She enjoys the small classes and finds that "I can't get away with not answering questions and not being part of things."

Paul: "It s a good thing." The oldest student interviewed was 18 year old Paul, a young man in his senior year at Wesley Academy. Paul saw computers as essentially helpful, but also spoke of the challenges they created. He had attended public schools through fifth grade, displaying some evidence of learning difficulties. As a result he went to a private school for sixth grade but went back to public school for seventh, where he was identified as having a learning disability. He attended another boarding school for eighth and ninth grade and enrolled at Wesley Academy as a boarding student in tenth grade. Paul revealed in his interview that he selected Wesley Academy because it offered the best financial aid package in

addition to the academic skills support program.

Interviews

The interviews were conducted at the schools during a time mutually convenient to the researcher and participant. Interviews were scheduled so that students did not miss any instructional time, except when teacher permission was obtained in advance and the students, especially the students with disabilities, would not be compromised in any way. The interviews were conducted in a quiet, distraction-free setting (e.g., empty classrooms and offices). This allowed for interview sessions in which the interviewer had the full attention of the students. If the interviews had been held in classrooms or dormitories, other ancillary data might have also been gathered, but these settings could have influenced the participants' attention to the questions. The participants were reminded of the estimated 45 minute duration of the interview at the start of the sessions.

The structure of the interviews followed an adapted version of Seidman's (1991) interviewing model which involves organizing the interview questions around three stages of information gathering: a) focused life history, b) the details of experience, and c) reflection on the meaning. Each interview progressed through these three stages, using guiding questions that were designed to elicit participants' experiences, opinions, and suggestions concerning students' use of computers in schools and whether such use is different for students with special needs. The guiding questions are found in Table 2. Each interview session started with these questions, but other follow-up questions were asked as appropriate. The researchers focused on learning how each participant experienced the use of computers in schools, especially regarding students with special learning needs. The terms used in these descriptions served as anchors for summarizing and expanding on each participant's responses to the interview questions. The interviewer was sensitive to the participants' individual cognitive styles and provided note paper for participants to draw or write on during the interview if it helped them address the questions. All interview sessions were audiotaped by the researcher using a portable micro-cassette recorder (Corrie & Zaklukiewicz, 1995). The audiotapes were transcribed by the first researcher. Accuracy of transcription was checked by having another typist transcribe portions of three interviews. Comparison of the matched transcripts showed .98 agreement between typists.

<Insert Table 2 about here>

Interview Analysis

The interview data were analyzed using Glaser and Strauss' (1967) open coding procedures. This approach is based on the use of a "grounded" method of generating theoretical understandings about the interview data (Glaser & Strauss, 1967). This method relies on the development of categories and properties directly from the data rather than the use of *a priori* external categories (Glaser & Strauss, 1967:36ff; see also Glaser, 1992 for further explanation). For example, the statement by Darren "I mostly played games on the computer" was coded as **uses – games**. This approach follows Seidman's (1991) suggestion that analyzing qualitative data is essentially a process of meaning-making. As such, the form and process of such analysis cannot be predicted but must evolve from the data at hand. For example, instances of how students use computers were not predicted, but coded from the students' statements about them as in the application of games as a sub-code of types of computer use.

The transcripts were analyzed by the researchers and then member-checked by an outside reader experienced with this form of research in order to ensure the trustworthiness of the interpretation of the data (Silverman, 1993; Wolcott, 1994). Both the researchers and outside reader used the same methods and procedures of analysis. Both looked at each transcript individually and coded the data without knowledge of what the other coder was doing. As recommended by Kvale (1996), Mason (1994), and Wolcott (1990), first all the interview transcripts were read, very general categories were identified, and finally, themes among the categories were articulated. The focus of the interpretation of the interview data was on key words or phrases which were repeated by individuals or several of the interview participants (Dey, 1993). Large chunks of text might be initially coded in regard to a central theme and then recoded later with greater attention to individual precision. An example from Darren's interview was this comment:

> I was six or seven when we first got our computer. My brother was really young and he didn't even bother the computer. I played games a lot on it: Space Quest, something like Move Runner, really old corny games most but they pretty much started me off on a computer gaming career (Darren, April 1997).

A first read of the above passage might lead to a general code of first computer experiences but a more complete analysis showed other codes such as uses, games, age, family involvement, and applications. Next, both the researchers and outside reader labeled all transcripts with codes generated from reading of the material. Once all the transcripts were coded, lists of codes and subcodes that represented the labels assigned to the texts were created.

After having created separate code lists from the data, the researchers and outside reader conferred and compared their codes. The researchers' code list consisted of six main coding categories: applications, applications in special education, instruction, social, attitudes, and, needs. Each of these main categories had a number of subcategories. The outside reader developed four main coding categories: uses, uses by learning disabled students, downside of computers, and needs. Again, each of these categories was accompanied by subcategories. For example, the researchers' subcodes for the above passage were uses – games, family, and applications. The outside reader's subcodes were games, programs, and age.

Through discussion and consensus, a combined coding list was generated for use by both the researchers and outside reader (Miles & Huberman, 1994), with a new code category developed: experience. This code list is found in Table 3. Both then re-coded all the transcripts with the new codes and met afterward to compare their results. Through discussion and consensus, disagreements on code assignments were resolved between the researchers and outside reader. Once the transcripts were fully coded in agreement by both the researchers and reader, a third outside reader, a college-level instructor, read three randomly selected transcripts and coded them using the revised common code list. While the majority of this reader's codes matched those of the researcher and outside reader, the third reader tended to use more general codes in places where the initial readers had used more specific subcodes. The third reader's code assignments were close enough to those of the researchers and outside reader to suggest general patterns, or themes, in the interviews. A table of all the codes and subcodes is found in the Appendix. The final interpretation of the interviews involved the development of five main themes based on the categories of data identified in the texts. These themes are discussed in the results section.

Trustworthiness of Interview Data

The qualitative methodology used here employed an open coding approach based on Glaser and Strauss' (1967) Grounded Theory. As Glaser (1992) has pointed out, however, the subsequent data create an hypothesis, not irrefutable conclusive data. Still, the reliability and validity of these findings are important (Kirk & Miller, 1986). In general, the reliability and validity of qualitative data can be evaluated based on six criteria (Leininger, 1994): a) credibility, b) confirmability, c) meaning-in-context, d) recurrent patterning, e) saturation, and f) transferability. A systematic approach to checking the above features of the data set is to use triangulation (Jick, 1983; Miles & Huberman, 1994). Triangulation involves comparing individual parts of the data across measurement devices. For example, in this study, multiple coders evaluated the transcripts and then the interviews of the individual students were compared to each other. This process is an

attempt to measure the overall consistency of the data as a way of determining internal and external reliability as well as overall validity.

Jick's (1983) model for triangulation suggests that triangulation can be done on a continuum, from simple to complex. This study used relatively complex methods in that convergent validation measures were applied. Convergent validation involves examining both within-group and between- group data sets from several angles to determine if the data collected are consistent (reliable) and if they measure what is intended (valid). Reliability was checked by having two outside raters code the interview data using the same methods used by the researchers. This provided a way to compare and cross-check the categories and themes of responses as interpreted by the researchers and the outside readers. Two methods were used to check the reliability of the transcript data. The use of selected sample dual transcription provided a verification of transcript accuracy. In addition, member checking procedures were used. Selected interview participants were given transcripts of their interviews to review for accuracy. No changes to the typed transcripts were requested.

Results

The interviews revealed a great deal about how the participating students think about computer use in schools. Comparison of the responses of those students with learning disabilities and those without showed that for most categories all students' interviews reflected similar themes and patterns. Nine main code categories were identified in the interviews: applications of computers, applications in special education, instructional uses, positive attitudes, negative attitudes, other attitudes, social, resource needs, and experience. Mentions of applications, applications in special education, instructional uses, other attitudes, and experience were all fairly evenly distributed between the two groups of students. Slightly greater differences were seen in the positive attitudes, social, and resource needs categories with students having learning disabilities not mentioning these topics as often as those students without learning disabilities (see Table 3). The greatest differences between the interviews of students with and without learning disabilities was the mention of negative attitudes. The students with learning disabilities spoke far more often of their own negative attitudes (e.g., frustration) about computers than did those students without learning disabilities. Nonetheless, the students with learning disabilities also spoke of positive experiences with computers and gave examples of how they had benefited from computer use (e.g., creating a better product in the end).

<Insert Table 3 about here>

Themes

Analysis of the categories and subcategories of statements led to the identification of five major themes in the interviews which represented the statements the participants made about computer use in schools. Figure 1 shows the five major themes and their inter-relationships. These themes point to the ways that teachers as well as students with and without learning disabilities view contemporary computer use in schools. Importantly, there were several areas of overlap which appeared as passages were coded. These overlapping themes suggest that the participants viewed computers as holding several functions or roles in schools and in special education. Synthesis of the categories of statements found in the interviews led to identification of the five main themes related to the use of computers by students with learning disabilities. Each theme is divided into branches. Applications of computers includes both academic and entertainment uses. Instructional uses involves both student skills and pedagogy (teaching methods). Attitudes incorporates positive, negative, and other (neutral) attitudes. Personal experiences with computers involves home and school-based experiences. Resource needs include computers as well as personnel. Together, these five themes appear to surround the use of computers by students with learning disabilities. The themes are interactional in that, together, they help to create attitudes about computer use through the shaping of personal experiences. The interviews themselves provide the best evidence of these interrelationships regarding computer use by students with learning disabilities. For example, how computers were used was influenced by one's attitudes, but these attitudes also shaped computer use. How, and if, computers were used by students was related to their positive and negative attitudes about computers as well as past experiences of computer use at home and school. Use was also highly influenced by the availability of computer resources, including hardware, software, support personnel, and training. All of these factors contributed to the ways that the interview participants experienced the use of computers by and for students with learning disabilities. As represented by the students who participated in the interviews, applications, instruction, attitudes, experiences, and resource needs are all important elements of how students with and without learning disabilities view computers.

<Insert Figure 1 about here>

Applications of Computers

"It has many uses" -Darren, ninth grade student, April 1997

Assignments. All the students spoke often of how helpful computers were for completing school assignments. Nathan commented that:

> …for an English assignment…it depends upon the quantity., I don't know, there's like this set line in my brain, it depends on how important the assignment is and how big the assignment is for both English and history… (Nathan, ninth grade student, April 1997).

Still, Nathan differentiated between when computers were and were not helpful for particular assignments based on the length of the writing to be done. Stewart mentioned the convenience of computers for completing homework in that they "help me a lot, because in my papers, I type fast to get them done…" (Stewart, sixth grade student, May 1997).

Tools. Darren, and others, referred to computers as "tools." When asked what this meant, Darren responded that "computers are tools with many uses that offer so many possibilities" (April, 1997). Many of the students made reference to how computers could be used as tools for learning in schools. There was an open-ended quality to these descriptions, reflecting a sense that computers are not limited to a few uses but could be used for, as sixth grader Stewart put it, "unmeasureable [sic]things" (Stewart, May 1997).

Communications. The students also talked about enjoying using computers for communications. Frances envisioned that students could use computers to interact with students from other schools and countries.

> If you have a pen pal, or if your school is working on a whole other country and you want to get information, or you want to talk to someone for an interview, so you will be able to talk to them…I can see kids working all together, like the whole class working on a huge project for their whole school (Frances, sixth grade student, April 1997).

By contrast, Michelle preferred to use computers for personal communication with friends. "I find that there are so many things I can do with computers. I can go on America Online and talk to so many people and it's changed just what I do daily" (Michelle, eighth grade student, May, 1997). Paul appreciated the availability of modems on the computers at his school so he could use them for research: "I use computers mostly for research projects, to look stuff up" (Paul, twelfth grade student, May 1997).

Games. All of the students felt that using computers for games is widely practiced among the students at these schools. Games were described by most students as enjoyable, often serving as a reward for completing school work. Darren referred to his computer "gaming career" (April, 1997). When asked what he meant, Darren indicated that he found computer games to be a healthy challenge for his mind and that he took pride in how his expertise at these games had improved over time. Darren also mentioned that computer games were a family activity in his home, providing an example of the connection between computer uses and attitudes and experiences.

While most students spoke of computer games in positive terms, Nathan referred to them many times with great

disdain. He saw them as "a bad use of time" (April 1997). When asked why, he said he gets frustrated when "kids are just playing their computer games when they could be doing so many better things even like reading a book... it's like hitting your head against a wall..." (April 1997). While Nathan's views on computer games were quite strong, they did not appear to be representative of the other students with learning disabilities in this study. Michelle spoke of how her attitudes about computers changed in third grade because "the games were funner [sic]" (Michelle, May 1997). Nathan's negative stance on games was the exception among the students. Nonetheless, it was clear that games were on the minds of all the students. Of note, there were no differences by sex among the students about computer games. Despite popular attention to how much boys love to play computer games, both the boys and girls revealed similar enjoyment of computer games.

Overall, the students held very similar views about the general applications of computers. They all reported that computers can be beneficial for school work and that they can be used for a variety of tasks. In terms of the general use of computers, the students did not differentiate how computers would help students with learning disabilities more than other students. The students mentioned that gaining familiarity with computers influenced their computer activities and confidence.

Instructional Uses

"The word processor is a savior." -Nathan, February 1997

Writing/Editing. While there was strong agreement that computers, and the word processing software they offer, had changed the experience of writing for many students, in particular those with learning disabilities, the perceptions of the quality of that experience did vary. The students with learning disabilities were not as enthusiastic about computer use for writing. Nathan and Michelle revealed that they feel that writing on a computer is less personal, even though it does help create a more presentable document. Particularly with regard to poetry, Michelle indicated that:

> ...I like to draw it from me or, I don't feel that I can get really my input, you know like "that's what I did" if I do it on computer. When you do it on computer it's final. You can't have the little cross out marks, you can't have, you know the little extras. But what you can do is to save it and then go back into it. But I find that if I have my little book then I can pull my book out and curl up into a blanket and write (Michelle, May 1997).

Michelle did see the benefit of being able to go back and edit saved work, but found computer composition to be less connected to her. Nathan echoed this sentiment. In relating his views about using computers in general for creative work, Nathan compared computer art to painting:

> I feel like Michelangelo painting the chapel, it's more a part of him and it's personal, just like writing, just like handwriting something is personal, when someone does it on the computer, it's harsh and just like typing something

> is harsh, it's...I like, like, being personal with people, like really getting into good conversations with them...(Nathan, April 1997)

Nathan also recalled that using computers for writing was not always a pleasant experience. While he does appreciate the value of being able to type a paper quickly, earlier experiences with computers still linger in his mind.

> I was just thinking this year how I've had to do substantial papers for history and stuff and now I can just sit down and just type it. And where, I think my typing ability is up to about standard, as fast as writing by hand, or maybe a little bit more, so I can just sit down and write it and I don't agonize over it like I used to (Nathan, April 1997).

Continuing, Nathan added: "I used to associate writing a big paper with using a computer and using a computer with pain" (April 1997). When asked why he associated computers with pain, Nathan recalled an early computer use experience:

> Because when I wrote that report in fifth grade it just took forever. And just using it [the computer] took hours and hours and hours and just using it was very boring and I wasn't, I just, I had trouble focusing on it and stuff like that (Nathan, April 1997).

Both Nathan's and Michelle's experiences with using computers for writing revealed aspects of computer use not evident among the students without learning disabilities who generally praised them for how they can help students with learning difficulties.

Spell checkers were the most mentioned feature of computers that can help students with learning disabilities. Almost all of the participants mentioned how using a spell checker benefits the writer and improves the quality of the final written product. As Nathan pointed out, "I'm a terrible speller and to use like a spell checker is incredibly helpful" (Nathan, April 1997). In creating a list of computer-related wishes for his school, Stewart listed spell-checkers: "I would have updated writing programs with spelling checkers and grammar checkers" (Stewart, April 1997). Still, several students also mentioned that many students do not use spell-checkers efficiently or properly. Frances suggested that some students do not use them as they could; "[Be]cause we all have computers but I'm not sure that they use spell-check...Because they don't know about it" (Frances, sixth grade student, May 1997).

Student-Centered vs. Teacher-Centered Pedagogy. In general, the ways that the participants described the role of computers in instruction reflected more student-focused instructional practices. Michelle commented on how having computers in the classroom changes the discourse between students and teachers:

> ...it's sort of like change of environment to go up to the computer room. And it's pretty much like a real classroom, it's just what we use on a special occasion...there's questions asked about how to do things instead of like how to say it. And there's questions, should I press this or will it erase that paper, or should I type this in? There's extra things asked or needed for what you happen to be working on in a computer classroom. You have that special

> interplay. And if the teacher doesn't know, you're out of luck. You need someone who has knowledge [about computers] (Michelle, May 1997).

Michelle also pointed out the need for trained personnel in the computer classroom, suggesting that teachers are still needed, if for different reasons.

Frances, a student without a learning disability, noted that computers could help students with "dyslexia, they can teach them the ABC's and vowel sounds" (Frances, May 1997). Michelle, a student with ADHD, explained how computers help students with learning disabilities: "You have to be up straight and giving full attention" (Michelle, May 1997). In response to the questions related to how computers might benefit students with learning disabilities, the interviewed students spoke most often of the role of assistive technology in helping such students. Their responses tended to be non-specific, but reflected a sense that assistive devices, including computers, could serve a compensatory function for students with special needs, especially learning disabilities.

As with the general applications of computers, writing was the most frequently mentioned application of computers specifically for students with special needs; it was mentioned almost as much as writing in general. Similarly, organizing was the second most common theme related to special needs uses, and it was closely followed by assistive technology. Together these features of computers were identified as important compensatory aids for students with disabilities. All of the students talked about how computers can be very beneficial for students in general. In addition, the students commented on how the instructional uses of computers are especially helpful for students with learning disabilities. Again, the students pointed to how their own level of expertise with computer use influenced the degree to which a computer enhanced their own school work. Importantly, the students with learning disabilities reported more negative past experiences with computers and indicated their current use of computers was influenced by these experiences.

Attitudes

"It's harsh." –Nathan, April 1997

Positive and Negative. The students made many statements reflecting both positive and negative attitudes about computers. The parity of the number of the students' positive and negative statements is striking but also reflects a dichotomous mindset which was seen in several of the students' interviews: "It was fun, but it was confusing" (Frances, May 1997). Many of the students described feeling both enjoyment and frustration when using computers; they revealed jointly held positive and negative opinions, neither of which seemed to overpower the other. Even the most enthusiastic computer

users reported feeling frustration and negativity with computers at times. Michelle reported that "our computer, it's a nice computer, but it always acts up…so I get easily frustrated with computers" (May 1997). Among the negative attitudes, several participants noted that computers are breakable and costly. Nathan mentioned that "they're breakable" (Nathan, May 1997). Stewart noted that it's inconvenient to be without a computer: "when my dad takes it in to get fixed, I have a whole bunch of things due tomorrow and I need my computer to print them out" (Stewart, April 1997).

Enjoyable. The most common positive attitudes that were expressed in the interviews included beliefs that computers make tasks easier, are enjoyable to use, make work go faster, and improve the quality. These attitudes often described the uses that students mentioned. Computers were reported to make writing easier and faster and many students expressed how they enjoyed using computers for games and other tasks. Frances noted that "…it made it easier" (May 1997). Stewart, a student without learning disabilities, connected computers with benefits for students with learning difficulties: "maybe for kids with learning disabilities, [we] might get bigger monitors…so that the typing would be bigger and it would be easier for them to read" (Stewart, May 1997).

Frances mentioned that using a computer for writing was both faster and easier "because, it made it easier than writing it all up because you have it on a piece of paper and it you lose that then you have it on your computer." She also talked about using the spell-checker "'cause I don't want to get in trouble" (Frances, May 1997). When asked about why this prevents her from getting in trouble, Frances indicated that it improves the quality of her papers and leads to better grades.

Frustrating. Among the negative attitudes expressed by students the most frequent were frustration and fear. These themes showed that the students did not see computers as all good. In particular, such attitudes indicated that there were identified drawbacks to computers which must be understood alongside the positive aspects. Citing frustration and other less-than-pleasant experiences, the students with learning disabilities offered a different picture of the convenience of computers. As a group, these three students shared stories suggesting that working with computers is not always easy and fast. Michelle revealed fairly negative attitudes about computers, referring to them as frustrating many times. Michelle's first computer experience was in first grade and she recounted that she didn't like it because "you couldn't look at the keys" (Michelle, May 1997). She also mentioned that at the time she was not on medication and perhaps that added to her frustration. Michelle found her next experience, at a new school in third grade, to be better. She indicated that she still gets frustrated when the computer cannot keep up with her typing but that she's learned "it's not the end of the world" (Michelle, May 1997). Showing a sense of the good and bad aspects of computers, Michelle revealed that "…in a way it just helps me

feel like I can organize it better without having to look over it a lot of times..." (May 1997).

As mentioned above, Nathan recalled how using a computer can also make the task take much longer. He also recalled long hours of time spent alone when he was supposed to be working on learning to type after school. These hours he remembered as "boring" and "not useful" because he could not see how he was ever going to type fast enough anyway. Nathan revealed that he had a very negative attitude about computers for several years because of his memory of being forced to learn to type by himself after school.

Paul mentioned that for him typing a paper on a computer was very difficult at first because: "well, I was pretty slow" (Paul, eleventh grade student, May 1997). Although all three of these students saw the benefit of using computers for writing in order to produce higher quality work, they shared experiences of "pain," "frustration," and long hours in getting to a point where computers were truly useful for writing tasks. This was different from the other students who were interviewed who did not reveal such feelings of fatigue or frustration in the process of learning how to use a computer for school work.

Less Personal. While holding a more extreme position than the other students, Nathan offered a comment about the potential negative effects of computer use by students, suggesting that "people are going to be socially stupid" (May 1997). In general, The students revealed interest and concern with the social components of computer use. In particular, several students mentioned a concern with having to share computers when using them for class work. Frances said that "I think it's easier to have your own computer because it's hard to switch when you're right in the middle of a paper and it's someone else's turn" However, Frances also conceded that "when you're doing a project with a partner or with a group, then you want to share a computer" (Frances, April 1997). There was relatively little mention of differences between the ways that boys and girls differ in computer use. Michelle noted that "in my computer classes the boys sort of don't what to do it, because it was boring" (Michelle, May 1997). There were no other indications that the students found significant differences in the ways that boys and girls make use of computers.

Potential. Several students spoke of the potential of computers. For example, Darren suggested that computers make an "equal offer to everybody. It's just a matter of whether someone is willing to look at stuff like that. There are so many possibilities" (Darren, April, 1997). Darren suggested that computer have much to offer schools.

As noted, the students with learning disabilities mentioned more negative attitudes about computers than their peers. Still, the students with disabilities also spoke about the positive things computers can do. Importantly, both groups of students mentioned the benefits that computers offer students even though computer use may sometimes involve frustration

and delays. The students noted that greater computer expertise can help minimize frustration with computers, but even expert users still have problems.

Personal Experience

"It was boring." -Nathan, April 1997

Home Experiences. Several of the participants revealed how much their past experiences with computers had shaped their ideas about how computers should be used in schools. All of the students indicated that they currently owned a computer and made reference to experiences and opportunities that having their own computers offered. For example, Darren and Stewart reported how "fun" it was to learn how to use the computers owned by their families, often asking questions of their parents and spending long hours investigating and learning about the many things a computer can do. Frances and Nathan mentioned that although their families own several computers, getting access to them alongside other family members was often difficult. Frances hinted at the importance of getting personal computer time, saying: "I find time" (Frances, May 1997).

School Experiences. These students also spoke of school situations involving computers which shaped their ideas about how computers should be used. However, the school-based experiences were less intimate and appeared less "fun". Both Frances and Stewart, who attended the same school, mentioned not liking having to share a computer with another student, wishing for more personal time with the school computers. Paul also mentioned how students' views about using computers for school work were shaped by their lack of access to them. "I don't think they really [like them]...the majority I guess wouldn't like it as much 'cause like a lot of kids in this school don't have computers, yet they're asked to do a lot of their projects on computers" (Paul, May 1997).

The students from each school offered glimpses of the computer cultures present at each school. The descriptions they shared help to provide pictures of the ways that computers were being used at each site. The trends in the students' descriptions about computer use were consistent across the individual students from each school, but did not differ between students with and without learning disabilities. Attention to resource needs was an important theme at Riverview. Also noticeable was that participants from Riverview made the largest number of mentions of the instructional uses of computers, indicating another strong theme at this school. This theme was interlaced with hopes for the arrival of their new computer equipment so they could use it for school assignments. Both the students at Riverview appeared very eager to use computers

more actively in classes. There was also a strong sense of cooperation and collaboration in these students to make the computers they had be available for as many students as possible.

Statements about issues of changes related to computer use were often seen in the interviews of Fairmont students. Striking was the finding that Fairmont had a much larger number of negative responses than the other schools. Fear was a recurring theme at Fairmont and suggests that the presence of a computer network is not necessarily related to improved attitudes or willingness to use computers. Alternatively, the negative statements at Fairmont need to be considered alongside the relatively low number for Riverview. Nonetheless, fear was a key theme at Fairmont and points to enduring issues that may follow after the installation of new computer equipment.

The main theme at Wesley Academy was how the computer has been used by and for students as a learning tool. Students from Wesley shared examples of how computers have been used for assignments in ways that make learning easier for students. In particular, there was a focus on how computers can make the overall curriculum more accessible to students. Interestingly, Wesley Academy participants revealed the fewest number of needs statements, despite having received minimal updated equipment in recent years.

While there was some differences in the computer-related themes that the students from each school mentioned, all the students pointed to the importance of computers for school-related work. Similarly, the students' attitudes about how computers can help students with learning disabilities did not differ by school. As noted, the participants from Fairmont, which had many more computers, were focused on how computers were used more than the participants from the other schools, who tended to mention the lack of computers.

Resource Needs

"We have computers, but only during certain times." Paul, May 1997

Material computer needs were articulated by several of the students, including Paul, who pointed out that "a lot of kids don't have computers, yet they're asked to do a lot of their projects on computers. We have computers, but only during certain times, and if you're not allowed to use the computers you're allowed to hand-write it" (Paul, May 1997). Hardware and training were the two most mentioned needs. Without adequate resources, it is impossible to develop programs for students that incorporate computer technologies.

Money/Staff Training. There were differences among the needs estimates at the schools. At Fairmont, there was less concern with hardware and more calls for training and instructional support. At Riverview and Wesley Academy, both

students and teachers were eager for more hardware which could be used by students. This result suggests that the availability of basic computer resources in a school, such as Fairmont had, did not diminish a sense of computer needs, but shifted the focus toward more complex, applications-oriented concerns. Overall, there was a general call for more training resources at all the schools. Stewart noted that most of his teachers lacked the skills to use computers for more than word processing: "They just let you use the computers as an option for doing your papers (Stewart, May 1997).

All the students mentioned some aspect of resource needs, but the perception of the need varied by school. Both the students with and without learning disabilities mentioned resource needs and spoke about how lack of access to either computers or computer instruction influenced the extent to which they could take advantage of the benefits computers offer students. Several of the students indicated that lack of computer access was preventing students from becoming more experienced with computers, and, by extension, preventing students with learning disabilities from taking advantage of the supports that computers can offer them.

What Was Not Said

What was not said about computers in the interviews is as important as what was said. The students who participated in the interviews did not question the presence of computers in their schools. Even Nathan, who was the most cautious about the role of computers, agreed that they are important for certain school-related tasks such as writing. There appeared to be silent agreement that computers offer something of value to schools and students. The silent concurrence that computers have a reason to be in schools reflects the purposefulness of their role. Of note, there were no differences between the students with and without learning disabilities concerning the silent concurrence about the presence of computers in schools. All the students, even Nathan, mentioned how computers were beneficial for students, especially students with learning disabilities.

Discussion

All the interview participants talked about many applications and uses for computers in their school-related work. The students' responses indicated that they believe that computers have an important and positive role in schools. The students also agreed that computers offer more to students with learning disabilities because they help such students deal with limitations that otherwise interfere with learning and work completion. The students noted that their own past experience with computers influenced how they used them for school work, suggesting that students' general computer experiences are important predictors of future use. The only major difference in the attitudes of students with and without learning

disabilities was related to their positive and negative attitudes. The students with learning disabilities reported more negative attitudes about computers, but also held positive attitudes as well. These negative attitudes came from past experiences with computers, such as being forced to learn how to type, that were not as positive as those of the other students, highlighting the importance of the quality of students computer experiences in shaping their attitudes about them. These findings support prior research which pointed to the quality of students' computer experiences in shaping their attitudes and use patterns (King, 1995; Kinnear, 1996).

There was a compelling sense in both what was and was not said that computers provide students with innovative and alternative points of access to school-based learning experiences. According to the students interviewed, it is the accessibility that computers offer to students with learning disabilities that best supports their use in schools. This sense of accessibility is found in the specific references to the computer resource needs of students as well as in the spirit or rationale for the use of computers in general. These interviews suggest that computers are useful for students with learning disabilities (as well as other students) because they offer ways of access to learning experiences that otherwise might be unavailable. Examples from the interviews suggesting how computers enhance accessibility included writing, reading, slower-paced instruction, individualized instruction, and student-centered instruction. All of these provide points of contact or entry (access) by students into learning tasks that would otherwise be more difficult or impossible. These findings confirm those of Fitzgerald and Koury (1996) and Male (1993, 1994), that computers are helpful tools for accommodating the needs of students with special needs.

The pervasiveness of writing in the interviews showed that students are using computers for writing tasks fairly regularly. Similar to Goldenberg (1989) and Goldenberg et al., (1984), in many cases the participants spoke of how computers have helped to enhance writing, especially for students with learning disabilities. Games were also frequently mentioned, however, not always with support. Of note, all the students mentioned computer games in their interviews and all but one viewed them favorably. Clearly games are an important part of what computers offer for most of these students and their role in education needs further investigation. Some participants referred to "good" games or those which are educational and perhaps these might have a role in computer-related instruction.

The interview data indicated that most of the participating students have generally positive attitudes about computers. In several cases, these attitudes were mediated by existing negative variables. Still, except in one case, Nathan, the positive aspects of computers were seen to outweigh the negatives. The participants did not seem to have difficulty

holding contradictory beliefs about computers and were comfortable with the pairing of positive and negative qualities. No prior research on the contradictory nature of computer attitudes was found in the literature and more research into this is needed. Of note, the three students with learning disabilities had less positive attitudes about computers than those without disabilities. In each case, these students expressed greater frustration with learning to use a computer and were more equivocal about what role computers should have in programs for such students. This finding is very important because it has implications for how enthusiastic students with learning disabilities might be about working with computers. At a minimum, teachers should learn how such students feel about computers and address student-specific discomfort and anxiety before and during the implementation of computer-assisted instruction. For example, teachers could survey students' computer attitudes prior to implementing computer activities and incorporate instruction and practice that helps students feel comfortable with the computer. The more negative attitudes of the students with learning disabilities also suggest that early intervention should not be limited to social and academic areas but should also include the introduction of technology. Our data suggest that if computers had been introduced to the students with learning disabilities earlier in their school careers in a proactive and supported manner, their present attitudes may have been more positive.

The most salient finding from the interview data was the connection between participant attitudes and prior experience. Similar to the findings of Proctor and Burnett (1996) and Kinnear (1996), these students revealed a relationship between their prior computer-related experiences and their current attitudes and opinions about their use. It was clear that many of the participants had developed their attitudes and opinions about computers from their past experiences, consciously or perhaps unconsciously. While this finding may seem overly obvious, it is not always addressed in policy and practice. Some individuals may find learning to use a computer generally difficult, however, the extent and duration of difficulty can be mediated by instruction and support. More importantly, it should not be assumed that just putting computers in classrooms is going to lead to their effective and immediate use (Cohen & Spenciner, 1993). How students and teachers use computers appears to be related to a number of personal variables, some of which could be mediated by schools. Providing students with instruction about how to use computers effectively and giving them opportunities to practice successful use of computers could help to reduce negative experiences. Given the apparent positive role of home-based computer experiences, offering more access to all students through the schools could also help to provide more equitable computer opportunities for all students.

School influence was also touched upon in the interviews. The interview data revealed that participants' attitudes and opinions about computer use were related to their school environments. This makes sense in that how these students and teachers had previously used computers shaped their sense of future potential usefulness. The lack of sufficient computer resources was a common theme for both the participants at Riverview and one of those from Wesley Academy. For these individuals, the amount and type of computer resources that these schools did or did not have was a shaping variable in how they were using computers for school related work. In addition, the students spoke of how training is also needed so that the even the most basic of computer features such as spell-checking can be used effectively. How schools, as well as teachers, incorporate computer use into instruction may have an important effect on the attitudes and opinions that students with and without learning disabilities hold about computers and whether they are likely to use them for school-related work.

Overall, the interviews provided important insights into how students with and without learning disabilities view computers. Both groups of students indicated that computers are generally useful tools that can be beneficial for school-related work. The students with and without learning disabilities noted that computers are especially helpful for students with learning disabilities because they offer features that help such students deal with the limitations of such disabilities. Noting such things as spell-checkers, font size, and ease of editing, all the students pointed to how computers can help students with learning disabilities. Still, there was a sense in the students' responses that computers are important tools for all students and that all students should have access to them for school work. Of note, the quality of the students' computer-related experiences varied and the students with learning disabilities revealed far more frustration and negative past experiences with computer use. These findings suggest that teachers need to recognize the tangible benefits that computers offer to students and be certain to provide appropriate and individualized computer-related instruction to all students. By making it possible for students with needs like learning disabilities to participate as fully as possible in general education classrooms, computers appear to have an important role in delivering special education services. Specifically, teachers should take into account student experiences and attitudes about computers when implementing any computer-based instruction. Activities which teachers can use to prepare themselves and their students for computer use include surveying students' computer attitudes, providing one-on-one computer instruction and support if needed, and incorporating ongoing training in effective computer use into the instructional activities. These steps will help to ensure that students with learning disabilities are enabled to develop positive and effective computer skills.

Summary

The interviews provided important additional information concerning the role of computers in special education. The experiences shared by the interview participants were unique and individual but also had some common themes. Using grounded theory methods, several main categories of information were identified in the participants' words. Of these, five major themes (Applications of computers, Attitudes, Instructional uses, Personal experiences with computers, and Resource needs) appeared as significant contributing factors in the experiences and beliefs that these students held about computer use by and for students with special learning needs.

Experience using computers was described by participants as a shaping variable in how they use computers for school-related work. Generally, these students viewed computers as a positive addition to schools and felt they have a special role for students with learning disabilities. Overall, the interview participants reflected a sense of optimism and support for the role of computers to help students with learning disabilities and suggested that they expect to see computers have an important and lasting role in helping such students find success in school. Still, the students also pointed to a need for greater computer resources for the benefit of all students. The participants indicated that computers can be helpful to students in general, but most especially to students with special needs like learning disabilities. To this end, there was a call from the students for increased access to computers and more frequent and systematic use of computers for school-related work. These findings suggest that both students with and without learning disabilities recognize how computers can be helpful tools. The interviews offered additional evidence that students' past experiences with computers are related to their attitudes and how they are likely to use them for school work. Educators can learn from these students the importance of providing computer access that offers adequate training and support for students with learning disabilities. Importantly, the findings from this study suggest that educators need to integrate instruction about technology into early intervention programs so that students with learning disabilities develop the skills and attitudes necessary for them to use computers effectively for school work.

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Table 1

Interview subject characteristics*

Student	School	Age	Grade	Sex	LD	Experience	Computer Skills
Darren	1	14	8	M	N	9	Good
Nathan	1	15	9	M	Y	7	Fair
Frances	2	11	6	F	N	6	Good
Stewart	2	11	6	M	N	7	Excellent
Michelle	3	13	7	F	Y	8	Fair
Paul	3	18	12	M	Y	11	Poor

*The names used here are pseudonyms

Table 2

Interview Guide

Stage	Questions
I: Focused History of Background and Computer Use	From your survey,* I know a little about your background. What else would you like to tell me about yourself? What do you think of when you think of computers? When and how did you first use a computer?
II: Details of Experience	Describe for me a situation in which you have used a computer for school work. How have your own computer skills influenced your use of computers for school-related work? What is your sense of how students in general view the use of computers in schools?
III: Reflection on the Meaning	How do computers change schools or individual classrooms? What do you think computers offer students with special needs? What do you see as the future of computers and other technologies in schools in terms of providing inclusive work environments?

* The interview data were part of a larger study in which surveys about computer attitudes were also collected.

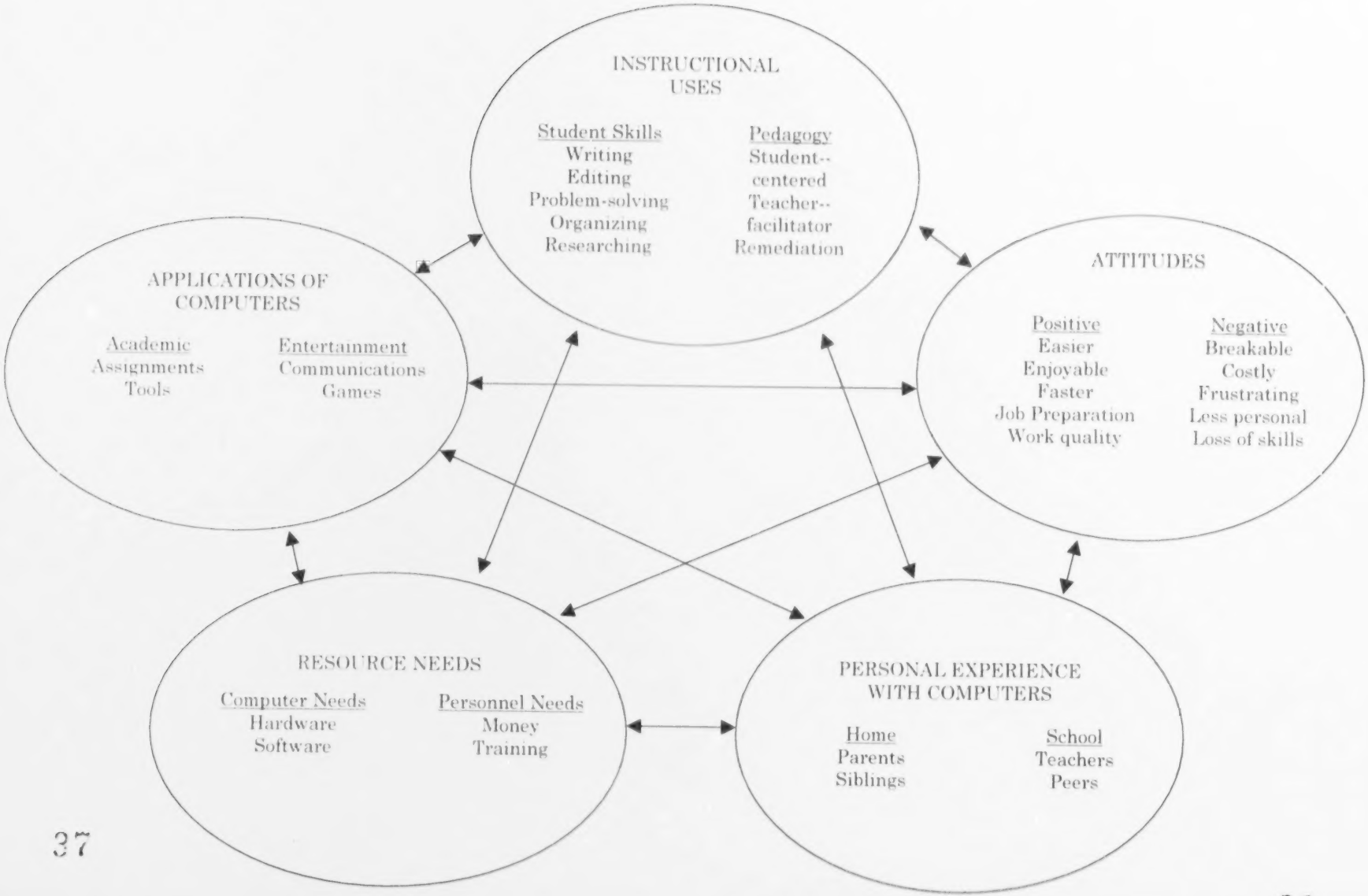
Table 3

Incidence and percentage of interview codes for all students, students with learning disabilities and students without learning disabilities

Code	All Students		Students with LD		Students w/o LD	
	N	%	N	%	N	%
Applications of computers	91	36	48	53	43	47
Applications in Special Education	18	07	9	50	9	50
Instructional uses	9	04	5	55	4	45
Positive attitudes	44	17	18	41	26	59
Negative attitudes	40	16	33	86	7	14
Other attitudes	13	05	6	46	7	54
Social	16	06	6	38	10	62
Resource needs	22	09	8	36	14	64
Experience	62	25	30	48	32	52
TOTAL	253	100	163	100	152	100

Figure Caption

Figure 1. How attitudes affect computer accessibility for students with and without learning disabilities


INSTRUCTIONAL USES
Student Skills
Writing
Editing
Problem-solving
Organizing
Researching
Pedagogy
Student--centered
Teacher--facilitator
Remediation
APPLICATIONS OF COMPUTERS
Academic
Assignments
Tools
Entertainment
Communications
Games
ATTITUDES
Positive
Easier
Enjoyable
Faster
Job Preparation
Work quality
Negative
Breakable
Costly
Frustrating
Less personal
Loss of skills
RESOURCE NEEDS
Computer Needs
Hardware
Software
Personnel Needs
Money
Training
PERSONAL EXPERIENCE WITH COMPUTERS
Home
Parents
Siblings
School
Teachers
Peers

Appendix

Interview Codes and Subcodes

Code	Subcodes	
1. Applications of Computers	1.1	Assignments
	1.2	Calculator
	1.3	Communication
	1.4	Editing (spelling)
	1.5	Games
	1.6	Organization
	1.7	Programming
	1.8	Research
	1.9	Teacher Prep.
	1.10	Tools
2. Applications in Special Education	2.1	Alternative Instruction
	2.2	Assessment/exams
	2.3	Assistive Technology
	2.4	Editing (spelling)
	2.5	Organizing
	2.6	Remediation
	2.7	Research
	2.8	Writing
3. Instructional Uses	3.1	Alternative presentation
	3.2	Assignments/drills
	3.3	Fosters problem solving
	3.4	Instructional assistant
	3.5	Integration of computers
	3.6	Student-centered
	3.7	Teacher as facilitator
4. Positive Attitudes	4.1	Beneficial to all
	4.2	Classroom behavior
	4.3	Cost effective communication
	4.4	Easier
	4.5	Enjoyable
	4.6	Faster
	4.7	Job preparation
	4.8	Legibility
	4.9	Professional
	4.10	Readability
	4.11	Work quality
5. Negative Attitudes	5.1	Breakable
	5.2	Costly
	5.3	Debilitating
	5.4	Fear
	5.5	Frustrating
	5.6	Lack of resources
	5.7	Less human contact
	5.8	Less personal
	5.9	Loss of other skills
	5.10	Not useful/boring
	5.11	Resistance to change

Continued next page

Codes and Subcodes, continued

6. Other Attitudes	6.1 Computers common
	6.2 Increases educational quality
	6.3 Teachers still needed
	6.4 Unlimited potential
7. Social	7.1 Enhances communication skills
	7.2 Fosters cooperation
	7.3 Gender differences
	7.4 More student-teacher discourse
	7.5 Need personal contact
	7.6 Prevents human interaction
	7.7 Self-centered students
8. Resource Needs	8.1 Access
	8.2 Hardware
	8.3 Money
	8.4 Personnel
	8.5 Software
	8.6 Training
	8.7 Typing
9. Experience	9.1 Family/Home
	9.2 School